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STUDIES ON THE ISOZYME VARIATION PATTERN AMONG INDIVIDUALS AND POPULATIONS OF THE ENDANGERED SPECIES *DEUTZIA MULTIRADIATA* (HYDRANGEACEAE) ON MT. JINFO OF NANCHUAN

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ABSTRACT

With the electrophoretic technique, we studied the peroxidase (PER), catalase (CAT), esterase (ES), amylase (AA), citric acid dehydrogenase (CDH), and glutamate dehydrogenase (GDH) in leaves of 41 plants from five small populations with different altitudes and habitats of the endangered species *Deutzia multiradiata* which is endemic to Mt. Jinfo of Nanchuan, China. The band number variation of those isozymes is studied by clustering analyses on Manhattan metric by UPGMA. The result indicates that though individuals within the same population show certain similarities in the isozyme band number, the electrophoretic difference in the band number and the genetic divergence within the same populations are notable, while most individuals from different populations show higher resemblance in the band number of those isozymes, which reveals that there are few relations between the band number of those isozymes and the collecting habitats of those plants.

KEY WORDS: multivariate analyses, isozyme variation, *Deutzia multiradiata*, Hydrangeaceae, China

Deutzia multiradiata W.T. Wang is a species endemic to Mt. Jinfo (29° 05′ N, 107° 10′ E) of Nanchuan County in Sichuan Province and belongs to subsect. *Cymosae* Rehder of sect. *Deutzia* in the genus *Deutzia* Thunberg of Hydrangeaceae (He 1989, 1990). It was published as a new series named ser. *Multiradiatae* P. He because of its unique morphological characteristics in subsect. *Cymosae* Rehder (He & Hu 1989; He & Pan 1994). Further studies show it also possesses some unique biological features. It is scattered as small populations in a very restricted area smaller than 10 km^2 from 600-1200 m altitude on Mt. Jinfo of Nanchuan. Based on our detailed observations and statistical works in the field over many years, we found there are no more than 800 living individuals of the species within its entire geographic distribution and that it is indeed an endangered species. It competes poorly when growing with other species such as Compositae and Poaceae with strong competitive abilities, but because of its highly developed root system, it mostly favors those exposed habitats with water-exuded limestone crevices where other plant species

cannot survive. Whether it is an adaptive strategy for a species such as *Deutzia multiradiata* to occupy the exposed micro-habitats where other species cannot survive, or this distribution is a retrogressive phenomenon, is not known. It is known that the survivorship and development of a given species is not only affected by the environmental conditions, but also regulated by its own genetic features. It is necessary to understand the genetic variation of such a restricted endemic and endangered species as *Deutzia multiradiata*.

MATERIAL AND METHODS

After multiple field observations and collections, the authors dug 78 living individuals from five populations of *Deutzia multiradiata* in April 1994. and transplanted them in native soil to plastic pots. These pots were then moved to the Botanical Garden of Southwest China Normal University. The collecting locations and their micro-habitats are shown in Table 1.

Table 1. The collecting localities and micro-habitats for the living material used in this study.

Population	Elevation (m)	Locality	Micro-habitat
A	600	Shanquan	limestone crevice
B	720	Banhe	damp scrub
C	800	Lower Daheba	cliff crevice
D	760	Yihaoqiao	slightly dry scrub
E	1200	Upper Daheba	talus slope

Sample preparation follows Wu (1979). The vertical plate polyacrylamide gel electrophoresis was conducted following Wu (1979) and Hu & Wan (1985).

Based on the schematic figures of the enzyme bands, we obtained the total band number for each individual and then inserted them into the original data matrix which was processed on a 386DX40 computer using BASIC programs for clustering analyses using a Manhattan metric under UPGMA (Zhong *et al.* 1990).

RESULTS AND DISCUSSION

In the isozymic dendrogram produced as a result of this study (Figure 1), 41 individuals were clustered into four Manhattan metric-0.82 isozymic phenons. The "A" Manhattan metric-0.82 phenon is composed of fifteen individuals from among populations A, B, C, D, and E, while the "B" Manhattan metric-0.82 phenon is composed of five individuals originating from populations A and C. The "C" Manhattan metric-0.82 phenon consists of thirteen individuals collected from populations A, B, C, and E. The "D" Manhattan metric-0.82 phenon is formed of a mixture of eight individuals from populations A, B, and D. Generally speaking, though some groups of individuals from particular populations cluster very closely (such as numbers 1-2-8, 12-17, 15-19, 3-4, and 21-22) and show high resemblance in

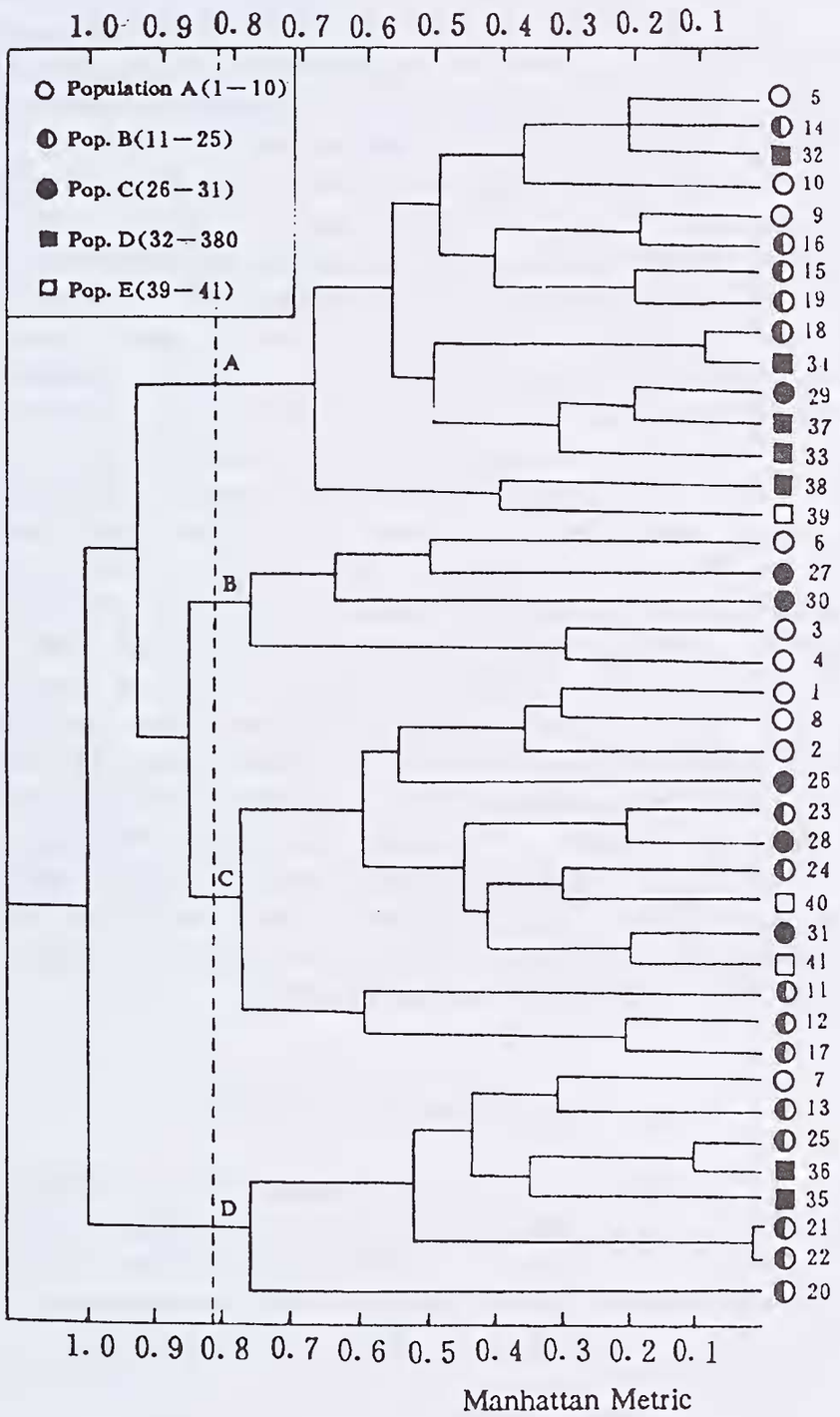

Fig.1 Dendrogram by the Manhattan metric with WPGMA, showing the variation in band number of six isozymes in leaves of 41 individuals from 5 populations of Deutzia multiradiata.

isozyme band number, most clusters are composed of individuals from several populations. On the other hand, some individuals from separate populations (*e.g.*, numbers 31-41, 40-24, 9-16, 29-37, 32-14-5, 18-34, and 36-25) have great similarity in band number. Therefore, isozyme band numbers of a plant do not show good correlation with the habitat from which it was collected.

Though there are similarities in band numbers for PER, CAT, ES, AA, CDH, and GDH in leaves of some individuals from the same population, certain genetic variation does occur among individuals within the same population. Conversely, some individuals from different populations show notable convergence in the isozyme band numbers. This indicates that isozyme band numbers of given plants are not correlated with the micro-habitat from which the plant was collected. *Deutzia multiradiata* was supposedly widely distributed in the past, with the current distribution restricted to a small area around Mt. Jinfo. During the long evolutionary history of the species, the isolated distribution of different populations limits gene exchange between individuals of different populations, which explains why some individuals from different populations show higher similarities in the isozyme band numbers, while the remarkable hybridizations among individuals of the same population lead to greater gene exchange and stronger divergence in the isozyme band numbers among individuals within the same population. Because the species can flower and pollinate easily, but most of its seeds are abortive, which makes the transferring of those rich genetic variations within the same population to their offspring nearly impossible so that it is more difficult for the fixation of those genetic variations as a genetic resource for the development of such a narrowly distributed endangered species as *D. multiradiata*. Though a few scattered habitats such as moist limestone crevices in a restricted area from 600 to 1200 m altitude on Mt. Jinfo can be favorable for the survival of *D. multiradiata* presently, owing to its paucity of genetic variation, it does not have a bright future if these habitats are changed.

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